

Characteristics of ovarian cancer in women residing in Aotearoa, New Zealand: 1993–2004

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ABSTRACT

Background: Few studies have compared ovarian cancer rates between different ethnic groups in the same country. The aim of this study was to describe ethnic patterns in the incidence and mortality of ovarian cancer in New Zealand, and to investigate ethnic and socio-economic differences in the grade and stage of ovarian cancer.

Methods: Data on all women registered with ovarian cancer on the New Zealand Cancer Registry (1993–2004) were analysed. Population data were taken from the 1996 and 2001 census. Logistic regression was used to estimate associations between ethnicity, deprivation and tumour characteristics.

Results: Age-standardised incidence rates were highest in Pacific women, intermediate in Māori women, and lowest in non-Māori, non-Pacific women. Age-standardised mortality rates showed the same pattern. Ovarian cancer subtypes differed by ethnic group. There was no significant association between socioeconomic deprivation and tumour grade or stage. Age-adjusted models showed that Māori women were more likely to have well-differentiated tumours and less likely to present at a later stage compared to non-Māori, non-Pacific women. These patterns were partly explained by socioeconomic deprivation, and were not apparent for Pacific women.

Conclusions: Pacific and Māori women experience higher incidence of ovarian cancer and mortality, compared to non-Māori, non-Pacific women. Māori women seemed to have better prognostic factors (local stage and well-differentiated tumours) than non-Māori, non-Pacific women. More work is needed to improve current cancer prevention strategies, particularly in Pacific women.

The incidence of ovarian cancer in New Zealand is similar to comparable countries, being slightly higher than Australia, Canada and the USA, but lower than the UK.¹ In 2003, ovarian cancer accounted for 2.9% of all female cancer registrations in New Zealand, and it ranked eighth highest in frequency of all female cancers.² International comparisons of mortality are similar, with New Zealand having rates between those in North America and the UK.¹ The proportion of all female deaths due to ovarian cancer was 4.4% in New Zealand. It is ranked the fourth highest cause of female cancer deaths, and has the highest age-standardised death rate (5.2 deaths per 100 000 females) of all reproductive cancers.²

Few studies have compared ovarian cancer rates between different ethnic populations in the same country, or between women of the same ethnic origin living in different countries. One recent investigation found little variation in incidence rates of ovarian cancer between urban women in

India and South Asian women in Singapore, the UK and the USA.³ In the USA, the incidence rates of ovarian cancer in African-American women are lower than in white women (rate ratio 0.7).⁴

Until recently, comparisons of incidence of and mortality from ovarian cancer have not been made between ethnic groups in New Zealand. Routinely published incidence and mortality data have only just begun to include ethnic-specific estimates for Pacific people but these rates are very imprecise, being based on data for only 1 year.² It has been suggested that ovarian cancer is somewhat more common in New Zealand Polynesians than European New Zealanders,⁵ and this is backed up by one analysis showing that Māori and Pacific women in New Zealand have one of the highest age-standardised incidence rates of ovarian cancer worldwide (13.8 and 17.6 per 100 000 respectively).^{6,7}

The aims of the current paper are twofold. First, to describe the incidence and mortality of ovarian cancer between Māori, Pacific and non-Māori non-Pacific women residing in New Zealand for the period 1993–2004; and second, to describe ethnic and socioeconomic differences in the grade and stage of ovarian cancer, and to see whether these are explained by socioeconomic position or ethnicity respectively.

METHODS

Data were obtained from the New Zealand Cancer Registry (NZCR) of all women with a primary diagnosis of ovarian cancer (ICD-10-AM, Second Edition, code C56) from July 1993 to December 2004. The information extracted from the NZCR data included tumour grade and stage, histology subtypes of ovarian cancer, and basic demographic information, including age and ethnicity.

The NZCR characterises ovarian tumour grade in four distinct categories: well-differentiated, moderately differentiated, poorly differentiated, and undetermined or not known. Since 1999, the recording of tumour stage, or the extent of the disease was standardised using the Surveillance, Epidemiology and End Results (SEER) Guide to Summary Staging.⁸ Prior to this, the New Zealand Health Information Service (NZHIS) used the numeric extent of disease codes, assigned by cancer registrars, which were applied to registrations up to and including 1998.⁹ Thus, combining the SEER guide and the numeric code, tumour stage was categorised into four categories: local, regional, distant and not known.

Age at diagnosis was grouped in two ways for different analyses. For descriptive analyses, age at diagnosis was divided into 15 5-year age-bands from 14–19 years to 85 years and older. For logistic regression analyses, age was included as a continuous variable.

In New Zealand, ethnic differences are an important consideration in examining and planning appropriate health services, particularly where there are policies aimed at reducing disparities in health between Māori, Pacific peoples and others (non-Māori non-Pacific).¹⁰ The NZCR utilises a prioritisation system for classification of ethnicity, where the highest priority is given to Māori, followed by Pacific ethnic groups. Thus, for the analyses in this study, ethnicity was grouped into three categories: Māori, Pacific, and non-Māori non-Pacific women, using the standard prioritisation system.¹¹

To measure socioeconomic position, domicile codes provided by the NZHIS to the New Zealand Deprivation Index 2001 (NZDep2001) were converted, as a standardised measure of socioeconomic deprivation. Based on the 2001 New Zealand Census, the index combines nine census variables. The index provides a deprivation score for each small area unit ("mesh-block") in New Zealand. These meshblocks are defined by Statistics New Zealand as geographical units, which contain a median of 90 people. Each meshblock is categorised between 1 (least deprived) and 10 (most deprived).¹² For our analyses, deciles were grouped into quintiles: 1–2 (least deprived); 3–4; 5–6; 7–8; 9–10 (most deprived).

Analyses

The analyses were performed with the SASTM (version 9.01) statistical package. Chi-squared tests were used to examine ethnic differences for clinical and demographic variables. Logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (95% CI) to investigate associations between ethnicity, socioeconomic deprivation and clinical variables (tumour stage and grade). In each instance, two logistic models were run for each dependent variable (grade and stage of tumour); the first model involved calculation of the age-adjusted OR, whereas the second model also included either ethnicity or deprivation, accordingly.

Ovarian cancer incidence (or mortality) was defined as the number of new registered ovarian cases (or ovarian cancer deaths) (aged 14+ years) during 1993–2004 per 100 000 person-years. For the denominator, census population estimates were obtained from 1993–2004 for each ethnic group: Pacific, Māori, and non-Māori non-Pacific peoples. Age standardisation of incidence and mortality rates was conducted using Segi's 1960 World Population weights.¹³

Missing data ($n = 195$) were excluded from the analyses, where domicile codes could not be matched to the NZDep2001 index. Fifteen cases were also omitted registered under age 14, or over age 95 years.

RESULTS

Based on the age at diagnosis, there were 3110 women who were registered on the NZCR from 1993 to 2004 as having ovarian cancer as their primary cancer diagnosis. Non-Māori non-Pacific women comprised 88% of the cases, whereas Māori accounted for 8% and Pacific women 4%. The average age at first diagnosis was 60.4 years (49.8 years for Māori women ($p < 0.001$), 52.1 years for Pacific women ($p < 0.001$), compared to 61.7 years for non-Māori non-Pacific women). Table 1 shows the distributions of clinical and demographic characteristics, by ethnicity. For stage of tumour, Māori women were more likely to be diagnosed with localised disease than non-Māori non-Pacific women. Across all ethnic groups, there was a large proportion of women (80%) with tumour grade coded as "undetermined", "unknown", "not supplied" or "not applicable", thus they do not

have a histological grade assigned. Among those who did have histology performed, Māori women were more likely to have well-differentiated tumours compared to non-Māori non-Pacific women. Table 1a shows the distribution of ovarian cancer subtypes, by ethnicity. Serous tumours were the most commonly recorded histological subtypes of ovarian cancer for Māori and non-Māori non-Pacific women (36.7% and 40.1% respectively). The most common ovarian cancer subtype among Pacific women was epithelial tumours (51.4%).

Incidence

Table 2 shows the age-specific incidence rates of ovarian cancer, by ethnicity, in New Zealand. Pacific women have the highest age-standardised incidence rates of ovarian cancer (11.2 per 100 000 Pacific women, 95% CI 9.5 to 14.0), whereas Māori women were intermediate (10.1 per 100 000 Māori women, 95% CI 8.8 to 11.5), and the lowest rates were seen in non-Māori non-Pacific women (9.4 per 100 000, 95% CI 8.9 to 9.7). Although the 95% confidence intervals for Māori and Pacific women were wide, there was only a small degree of overlap comparing Pacific to non-Māori non-Pacific women.

Mortality

In table 3, Pacific women had the highest age-standardised mortality rate of 6.3 deaths per 100 000 Pacific women (95% CI 4.6 to 8.0). Māori women were intermediary (5.8 per 100 000 Māori women, 95% CI 4.7 to 6.9) and "Other" women were less (4.8 deaths per 100 000 non-Māori non-Pacific women, 95% CI 4.5 to 5.0).

The relationship between deprivation and grade/stage of tumour is shown in table 4. Women in the most deprived quintile were more likely to have missing data ("not determined" grade) compared to those in the least deprived quintile. These differences persisted after adjusting for ethnicity (OR 1.41, 95% CI 1.04 to 1.92). It is noticeable that this effect is evident only in the most deprived quintile, and that it is not a linear effect across all levels of deprivation. Having excluded the 2515 women with missing data, there was no significant association between deprivation and tumour grade. Given the high proportion of women who were excluded, the high chance of selection bias is discussed below. There was a suggestion that women who lived in the most deprived areas were less likely to have regional or distant spread compared to those in less deprived areas, but none of the stratum-specific ORs were statistically significant. These results were not altered following adjustment for ethnicity.

The relationship between ethnicity and grade/stage of tumour is shown in table 5. Māori and Pacific women are more likely to have tumours with a grade that was "not determined" compared to non-Māori non-Pacific women. However, this association was not significant at the conventional level of $p < 0.05$. Part of this relationship was explained by deprivation. Among women with complete data, Māori women were more likely to have "well-differentiated" tumours compared to women of "Other" ethnicities. Part of this effect was due to age and deprivation, but the association remained in the adjusted results. Again, the large number of missing data requires these results to be interpreted with caution. There was no difference in grade between Pacific and non-Māori non-Pacific women. There was weak evidence to suggest that Māori women were more likely to have ovarian cancer classified as "local", compared to non-Māori non-Pacific women. Part of this effect was explained by deprivation. There was no relationship between stage at diagnosis and ethnicity for Pacific tumour and non-Māori non-Pacific women.

Table 1 Distributions of ovarian cancer characteristics, by ethnicity

	Non-Māori non-Pacific (n = 2746)	Māori (n = 248)	Pacific (n = 116)	All women (n = 3110)
	n (%)	n (%)	n (%)	n (%)
Age (years)				
14–19	27 (1.0)	5 (2.0)	3 (2.6)	35 (1.1)
20–24	24 (0.9)	8 (3.2)	3 (2.6)	35 (1.1)
25–29	53 (1.9)	14 (5.6)	3 (2.6)	70 (2.2)
30–34	61 (2.2)	16 (6.5)	8 (6.9)	85 (2.7)
35–39	99 (3.6)	23 (9.3)	5 (4.3)	127 (4.1)
40–44	142 (5.2)	24 (9.7)	15 (12.9)	181 (5.8)
45–49	207 (7.5)	26 (10.5)	16 (13.8)	249 (8.0)
50–54	283 (10.3)	33 (13.3)	6 (5.2)	322 (10.3)
55–59	287 (10.4)	34 (13.7)	13 (11.2)	334 (10.7)
60–64	284 (10.3)	29 (11.7)	18 (15.5)	331 (10.6)
65–69	295 (10.7)	16 (6.4)	11 (9.5)	322 (10.3)
70–74	308 (11.2)	10 (4.0)	7 (6.0)	325 (10.4)
75–79	288 (10.5)	4 (1.6)	5 (4.3)	297 (9.5)
80–84	220 (8.0)	4 (1.6)	3 (2.6)	227 (7.3)
85+	168 (6.1)	2 (0.8)	–	170 (5.5)
p<0.0001				
NZDep				
1–2	446 (17.3)	7 (2.9)	6 (5.8)	459 (15.7)
3–4	484 (18.8)	30 (12.4)	10 (9.6)	524 (17.9)
5–6	549 (21.4)	32 (13.3)	18 (17.3)	599 (20.6)
7–8	609 (23.7)	52 (21.6)	17 (16.3)	678 (23.3)
9–10	482 (18.7)	120 (49.8)	53 (50.9)	655 (22.5)
Missing	176	7	12	195
p<0.0001				
Stage				
Local	739 (26.9)	97 (39.1)	37 (31.9)	873 (28.1)
Regional	240 (8.7)	11 (4.4)	11 (9.5)	262 (8.4)
Distant	1504 (54.8)	114 (45.9)	57 (49.1)	1675 (53.8)
Unknown	263 (9.6)	26 (10.5)	11 (9.5)	300 (9.6)
p<0.0001				
Grade				
Undifferentiated	15 (0.5)	1 (0.4)	–	16 (0.5)
Well-differentiated	112 (4.1)	15 (6.0)	6 (5.2)	133 (4.3)
Moderately differentiated	155 (5.6)	9 (3.6)	5 (4.3)	169 (5.4)
Poorly differentiated	287 (10.4)	19 (7.7)	12 (10.3)	318 (10.2)
Undetermined	2177 (79.3)	204 (82.3)	93 (80.2)	2474 (79.5)
p<0.539				

a Distributions of ovarian cancer subtypes, by ethnicity

	non-Māori non-Pacific (n = 2476)	Māori (n = 199)	Pacific (n = 105)	All women (n = 2780)
	n (%)	n (%)	n (%)	n (%)
Other tumours, not otherwise specified	478 (19.3)	47 (23.6)	21 (20.0)	546 (19.6)
Epithelial tumours	792 (32.0)	63 (31.7)	54 (51.4)	909 (32.7)
Serous tumours	993 (40.1)	73 (36.7)	23 (21.9)	1089 (39.2)
Mucinous tumours	112 (4.5)	6 (3.0)	3 (2.9)	121 (4.4)
Sex cord-stromal tumours	44 (1.8)	4 (2.0)	–	48 (1.7)
Germ cell tumours	57 (2.3)	6 (3.0)	4 (3.8)	67 (2.4)

p = χ^2 test of association between ethnic groups, excluding missing and unknown data; NZDep, New Zealand Deprivation Index 2001 is a scale based on census information, where 1 represents the 10% least deprived and 10 represents the 10% most deprived areas in New Zealand.

n, number of registered cases, missing data = 330 cases

DISCUSSION

This research has yielded key findings on the characteristics of ovarian cancer in New Zealand women. Most notably, the average age at diagnosis is lower in Pacific and Māori women and they have higher age-standardised incidence of ovarian cancer, and mortality rates, compared to non-Māori non-Pacific women. Māori women were more likely to have “well-differentiated” grade tumours, and localised staged ovarian cancer. A significant association was found between those

women living in the most deprived quintile and having “undetermined” tumour grade.

The current study supports previous research that has also shown high ovarian cancer rates in Pacific and Māori women.^{7 14 15} The present findings for Pacific women are similar to reported age-standardised rates of ovarian cancer from Pacific Island countries including Tonga and Native Hawaiians, with the exception of Niue, Samoa and French Polynesia, where the incidence rates were considerably lower.^{6 7 16–18} More than likely,

Table 2 Age-specific incidence rates per 100 000 of ovarian cancer, by ethnicity, 1993–2004

Age group (years)	Non-Māori non-Pacific		Māori		Pacific		All women	
	No. of cases	Rate	No. of cases	Rate	No. of cases	Rate	No. of cases	Rate
14–19	27	1.6	5	1.2	3	1.8	35	1.6
20–24	24	1.8	8	2.7	3	2.3	35	1.9
25–29	53	3.7	14	5.1	3	2.4	70	3.8
30–34	61	3.8	16	5.9	8	6.6	85	4.3
35–39	99	6.1	23	9.4	5	5.0	127	6.5
40–44	142	9.3	24	11.8	15	18.5	181	10.0
45–49	207	14.9	26	16.7	16	25.6	249	15.5
50–54	283	23.7	33	27.9	6	12.5	322	23.6
55–59	287	29.5	34	37.2	13	35.5	334	30.4
60–64	284	34.3	29	40.9	18	64.2	331	35.7
65–69	295	38.8	16	31.9	11	50.4	322	38.7
70–74	308	42.7	10	30.9	7	45.2	325	42.3
75–79	288	47.6	4	21.5	5	53.1	297	46.9
80–84	220	50.3	4	41.6	3	59.5	227	50.2
85+	168	45.4	2	49.6	–	–	170	45.1
ASR* (95% CI)	9.4 (8.9 to 9.7)		10.1 (8.8 to 11.5)		11.2 (9.5 to 14.0)		9.6 (9.2 to 9.9)	

The crude incidence rate for all women was 15.8 per 100 000.

*ASR, age-standardised rates, standardised to Segi's (1960) population weights.

the low incidence rates previously reported reflect an older study population and lifestyle habits that were predominantly Polynesian dietary habits at the time.^{16 17} The high ovarian cancer rates in the present study, could in part be explained by obesity, as it is well established that obesity is strongly associated with cancer risk^{19–21} and Pacific women residing in New Zealand are 2.5 times more likely to be obese than other women in the general population.²² On the other hand, increased parity is considered protective against this cancer,²⁰ an association that is not consistent with the elevated incidence rates seen in Pacific (and Māori) women who have high known fertility rates.²³ A possible biological plausible explanation for the high incidence rates among Māori and Pacific women could be related to certain reproductive risk factors. The use of combined oral contraceptives is strongly protective against ovarian cancer.^{24 25} However, there is currently no data on this in Māori and Pacific women, thus further research is necessary. The number of ovulatory cycles is highly dependent on parity, oral contraceptive use and the time of breastfeeding.²⁶ However,

there is less agreement in the literature as to whether the protective effect is due to having the reduced number of ovulatory cycles, or to the reduced stimulation of the ovary by gonadotropin,²⁷ or progestin-induced apoptosis.²⁸ Further research is in order to clarify the role of these reproductive factors, which could partially explain why some women have higher or lower incidence rates of ovarian cancer.

A possible genetic explanation for high incidence rates could be that between 5 and 10% of ovarian carcinomas are directly hereditary, and that the most common form occurs in women with BRCA1 or BRCA2 mutations.²⁹ The reasons underlying why women of different ethnic groups are more likely to be diagnosed with certain cancer subtypes are not known, thus requires further research. It is possible that genetic predisposition may play a role in determining disease risk.

It was also found that Māori and Pacific women, and those living in the most deprived areas, were more likely to have missing data for graded tumours, compared to non-Māori non-Pacific women. Information on tumour stage and grade is

Table 3 Age-specific mortality rates per 100 000 of ovarian cancer, by ethnicity, 1993–2004

Age group (years)	Non-Māori non-Pacific		Māori		Pacific		All Women	
	No. of deaths	MR	No. of deaths	MR	No. of deaths	MR	No. of deaths	MR
14–19	3	0.2	1	0.2	3	–	4	0.2
20–24	–	–	–	–	–	–	–	–
25–29	5	0.3	1	0.4	5	–	6	0.3
30–34	16	1.0	5	1.8	16	1.7	23	1.2
35–39	10	0.6	6	2.5	10	0.9	17	0.9
40–44	35	2.3	11	5.4	35	3.7	49	2.7
45–49	54	3.9	10	6.4	54	17.6	75	4.7
50–54	119	9.9	19	16.1	119	8.4	142	10.4
55–59	158	16.2	11	12.0	158	5.4	171	15.5
60–64	174	21.0	23	32.5	174	39.2	208	22.4
65–69	201	26.5	18	35.9	201	45.8	229	27.6
70–74	229	31.8	8	24.8	229	38.7	243	31.6
75–79	229	37.9	4	21.5	229	31.8	236	37.3
80–84	219	50.0	3	31.2	219	39.7	224	49.5
85+	164	44.4	2	49.6	164	–	166	44.1
ASR (95% CI)	4.8 (4.5 to 5.0)		5.8 (4.7 to 6.9)		6.3 (4.6 to 8.0)		4.9 (4.7 to 5.2)	

The crude mortality rate for all women was 9.1 per 100 000.

ASR, age-standardised rates, standardised to Segi's (1960) population weights.

Table 4 Association between deprivation level and tumour features: grade and stage

	OR* (95% CI)	OR** (95% CI)
Grade of tumour: not determined vs poorly/moderately/well-differentiated tumours (n = 2899)		
NZDep 1	1.00	
NZDep 2	0.94 (0.69 to 1.26)	0.93 (0.69 to 1.25)
NZDep 3	1.18 (0.88 to 1.60)	1.17 (0.87 to 1.58)
NZDep 4	1.14 (0.86 to 1.52)	1.13 (0.84 to 1.50)
NZDep 5	1.48 (1.10 to 2.01)	1.41 (1.04 to 1.92)
Grade of tumour: well- vs poorly/moderated differentiated tumours (n = 595)		
NZDep 1	1.00	
NZDep 2	1.40 (0.71 to 2.78)	1.37 (0.69 to 2.73)
NZDep 3	1.56 (0.78 to 3.11)	1.54 (0.77 to 3.06)
NZDep 4	1.52 (0.79 to 2.95)	1.48 (0.76 to 2.87)
NZDep 5	1.36 (0.67 to 2.73)	1.30 (0.64 to 2.67)
Stage of tumour: regional/distant vs local stage ovarian cancer (n = 2640)		
NZDep 1	1.00	
NZDep 2	0.99 (0.74 to 1.35)	1.00 (0.74 to 1.35)
NZDep 3	1.04 (0.77 to 1.39)	1.04 (0.77 to 1.39)
NZDep 4	0.97 (0.73 to 1.28)	0.97 (0.73 to 1.29)
NZDep 5	0.84 (0.64 to 1.12)	0.85 (0.64 to 1.14)

*Adjusted for age.

**Adjusted for age and ethnicity.

important as it provides an indication of the likely prognosis and optimal treatment options. For Pacific women, and those in deprived areas, a likely explanation is that these women presented with advanced disease, which is not treated surgically, and therefore histological specimens were probably unavailable for assessment. Recent data from the New Zealand Health Survey indicated that women aged 20–69 years in the most deprived quintile (based on NZDep2006),²² and Pacific women were significantly less likely to utilise cancer prevention services available from their health care provider.³⁰ In the present study, as Pacific women were more likely to be diagnosed at a later stage of ovarian cancer (regional/distant) compared to Māori women, this in part may explain the higher mortality rates among Pacific women. Further work is necessary to investigate why Pacific women (and those from lower socioeconomic backgrounds) tend to present with advanced stage of disease, and in particular to identify reasons for lower access rates and participation in health support services³⁰ and, or whether cultural factors influence their health behaviours (Personal communication. Steve Fleming, 2008).

Māori women on the other hand, were more likely to be diagnosed at an earlier “age” and “stage” of the disease, than non-Māori non-Pacific women. The authors cannot explain this finding, other than the possible notion that Māori women who

presented with early stage ovarian cancer were possibly treated for other co-existing medical conditions, which may have led to an earlier diagnosis (Personal communication. Steve Fleming, 2008). This finding echoes that of Robson and others who reported that Māori women were more likely to be diagnosed with ovarian cancer at an earlier stage of the disease than non-Māori women,¹⁴ although they did not find any significant differences between Māori and non-Māori when adjusted for age. Reasons for this remain unclear; however, Māori women being diagnosed at an earlier stage of disease may explain their likely survival advantage over Pacific women, as previously found by Jeffreys and co-workers.³¹ Additional information and understanding of diagnostic patterns of care in Māori women could benefit others, especially if this could be translated to other ethnic groups.

Finally, the present study found that Pacific women present more with epithelial ovarian subtype tumours whereas Māori and non-Māori non-Pacific women appear more susceptible to serous ovarian cancers. To the authors’ knowledge, no studies have compared ovarian cancer subtypes between different ethnic populations in the same country, or between women of the same ethnic origin living in different countries, thus further research to examine why specific ovarian cancer subtypes appear more common in different ethnic groups may be useful.^{5–29}

Table 5 Association between ethnicity and tumour features: grade and stage

	OR* (95% CI)	OR** (95% CI)
Grade of tumour: not determined vs poorly/moderately/well-differentiated tumours (n = 3,094)		
Non-Māori non-Pacific	1.00	
Māori	1.36 (0.96 to 1.92)	1.24 (0.87 to 1.78)
Pacific	1.13 (0.71 to 1.81)	1.24 (0.73 to 2.10)
Grade of tumour: well- vs moderately/poorly differentiated tumours (n = 620)		
Non-Māori non-Pacific	1.00	
Māori	1.53 (0.77 to 3.03)	1.42 (0.71 to 2.85)
Pacific	0.99 (0.37 to 2.65)	0.82 (0.25 to 2.67)
Stage of tumour: regional/distant vs local stage ovarian cancer (n = 2810)		
Non-Māori non-Pacific	1.00	
Māori	0.86 (0.64 to 1.16)	0.92 (0.67 to 1.25)
Pacific	1.12 (0.73 to 1.73)	1.13 (0.71 to 1.78)

*Adjusted for age.

**Adjusted for age and deprivation.

Limitations

There are a number of limitations to the study that should be considered. First, the precision with which the authors were able to determine ethnic-specific ovarian cancer rates was limited by the small numbers of Māori and Pacific cases. Second, there is diversity between specific Pacific ethnic groups; thus, the present findings are not directly comparable to studies of women in the Pacific Islands.^{6 7 16–18} Third, although the NZCR endeavours to differentiate between New Zealand resident and non-resident cases, there is still the potential that some non-resident cases have been included in the present analyses, resulting in inflated incidence rates. Furthermore, some cancer registrations with unspecified ethnicity were included in the non-Māori non-Pacific group, which would have reduced the observed differences between ethnic groups.² The final limitation relates to the large proportion of women in the present sample with missing data. The reasons underlying this could be attributed to errors in coding, or that histopathology samples were not taken, or that the different information sources (clinical, radiological, histological, autopsy or death certificate) providing cancer diagnosis were incomplete. The lack of complete information on stage and grade at diagnosis will affect the precision of the estimates produced by this study introducing the possibility of selection bias.

Conclusion

In conclusion, this study found that Pacific and Māori women experience higher incidence and mortality from ovarian cancer compared to non-Māori non-Pacific women, although Māori women were more likely to have better prognostic factors (local stage and well-differentiated tumours), than non-Māori non-Pacific women. It was found that ovarian cancer subtypes differed by ethnic group and further research examining this

area is warranted. At the same time, more work is needed to improve current cancer prevention strategies, particularly in Pacific women.

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What is already known on this subject

- In New Zealand, ovarian cancer has the eighth highest number of female cancer registrations, and the fifth highest number of female cancer deaths.
- Few studies have examined ovarian cancer incidence and mortality between ethnic groups in the same country, or between women of the same ethnic origin living in different countries.
- This study describes the incidence and mortality rates of women with ovarian cancer between three ethnic groups in New Zealand.

What this study adds

- It has been shown that in New Zealand, Māori women have better prognostic factors than non-Māori non-Pacific women from ovarian cancer; however, the reasons remain unclear, and further research is needed to understand this relationship.
- This study also highlights the necessity of improving cancer prevention strategies particularly for women who are of Pacific ethnicity.

Characteristics of ovarian cancer in women residing in Aotearoa, New Zealand: 1993-2004

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